advances of science since the ninth edition was prepared, in so far as they come within the purview of the present volume. Whether considered as one volume of a supplement to the ninth edition or as a statement of the position of many scientific subjects, the work is a worthy addition to our national literature.

PRACTICAL PHYSIOLOGY.

Directions for Class Work in Practical Physiology. Elementary Physiology of Muscle and Nerve and of the Vascular and Nervous Systems. By E. A. Schäfer, LL.D., F.R.S. Pp. 76. (London: Longmans, Green and Co., 1901.) Price 3*s.* net.

THE contents of this book are well-nigh sufficiently indicated by its subsidiary title, and it is inconceivable that in dealing with the elementary aspects of the subjects named its distinguished author could go wrong. He informs us that his directions are based upon an experience of many years in University College, London, and that they deal "only with such elementary exercises as can readily be worked out by even a large class."

There are twelve chapters in all, and the most distinctive feature of the book is the manner in which the student, having been given concise instructions as to the nature and mode of utilisation of apparatus, and of preparation of the organic object to be studied, is left to "notice" or observe for himself the nature of the effect of this or that operation. A most wholesome procedure—a method of the kind which must be always begotten of a lengthy teaching experience such as the author proclaims.

Of the twelve chapters, the first opens with a description of the "voltaic element" and of the Daniell cell, the rationale of the replacement of the former by the latter being clearly explained. The Grove and Leclanché cells, with the chief types of the latter, are in turn considered; and, with adequate descriptions of electrodes, keys, rheochords, the induction coil and their uses, and a section on unipolar induction, the chapter closes. Chapters ii. and iii. are devoted to nerve-muscle preparations, the sartorius being utilised for the demonstration of the independent irritability of muscle and nerve, and the hyoglossus for that of the "latent period." The effects of heat and cold, of fatigue, the action of curari and veratrin, are in due course considered and clearly set forth; and in chapters v., vi. and vii. the effects of successive stimulation, leading up to tetanus and the muscle sound, the rate of the nervous impulse, the effects of CO_2 and the "electrotonus" phenomenon, are simply described, Ritter's and Pfluger's laws being incidentally laid down.

Chapter viii. deals with secondary contraction and the use of the capillary electrometer and galvanometer. The two chapters which follow are devoted to the heart, cardiac nerves, and the use of the plethysmograph; and the two which conclude the work deal with the chief vascular and respiratory mechanisms in man, with reflex action and its time limitations, as determinable by the use of the Wallerian lever apparatus.

There are in all forty-five simple text-illustrations, thirty-eight of apparatus and seven of dissections of the common frog. The book is well worthy its aim, and Prof. Schäfer, clearly of a mind to give the elementary student little and good, has done that functionary a great service.

There are, in addition to the seventy-six printed pages, twenty-six which are blank; but whether, according to the bookbinder's custom, these are intended to give stability to an otherwise thin volume, or whether they are for the convenience of the student in making annotations, we are not informed. As matters now progress, however, in electrophysiology, it would seem that ere long one or two of these blank pages may be destined to bear a thirteenth chapter, since the Eastern mind, coming fresh and untrammelled to the work, is showing us that under a mechanical stimulus phenomena of electrical response akin to those until recently demonstrated only for the higher animals and the sensitive plants, appear to be at least also obtainable from vegetable organisms at large—a result which points to the conclusion that in these well-known phenomena we are dealing with a fundamental property of protoplasm, and calls for immediate investigation of the unicellular organisms, in the study of which the clue to all that is physiological has ever to be sought.

OUR BOOK SHELF.

The Elements of Physical Chemistry. By J. Livingston R. Morgan, Ph.D. Second edition. Pp. x + 352. (New York: Wiley and Son; London: Chapman and Hall, Ltd., 1902.) Price 2 dollars.

To write a book the object of which is to present the elements of the entire subject of physical chemistry, together with the important and but little known applications of it to the other branches of chemistry, within the scope of 322 small pages is by no means an easy task. The author has, however, succeeded in presenting within these limits a very readable account of the subject.

To the reader familiar with the works on physical chemistry and electrochemistry published by German authors during the last ten years, a close likeness between these and the present volume is at once apparent. The author, as a matter of fact, in his preface states that no claims of originality are made for the major portion of the text.

It is doubtful whether a text-book which is obviously intended for the use of comparatively elementary chemical students should be so replete with mathematical formulæ. For a beginner, a more descriptive method of treatment of the subject would have been, in the opinion of the reviewer, more satisfactory.

The subject-matter is divided into ten chapters, the first being devoted to introductory remarks on the subject of energy and methods of determining atomic weights; then follow sections on the gaseous, liquid and solid states, solution, thermochemistry, chemical change, phases and electrochemistry, the last chapter containing a series of 156 problems bearing upon the subject-matter of the text. This last chapter is a most welcome innovation. For the beginner, the very numerous and abstract formulæ of physical chemistry have but a vague significance; only when these formulæ have been applied to concrete cases do they become properly understood by the student. Ample scope for exercise in the application of these formulæ is provided by the last chapter, although perhaps in a few cases the problems are not very happily chosen.

Thermochemistry and the phase rule are treated of in a superficial manner, only five pages being devoted to the consideration of the latter. In a future edition it is hoped that the author will see fit to deal with the important work which has been done on transition tem-

peratures and the formation and decomposition of double salts. Although the present volume is a second edition of the work, yet the text is not free from misstatements. On p. 87 we are told that "when liquids mix in all proportions . . . then it is possible to make a complete separation of the constituents by a fractional distillation, provided the vapour pressures of the two differ," a statement which is afterwards contradicted by examples which are given of the different types of liquid mixtures. On p. 210 we are told that the ferrous ion is greenish-black in colour, and on p. 260 that all binary organic acids satisfy the dilution law of Ostwald. Misprints are also not uncommon and authors' names are not always correctly spelt, "Tammen" for "Tammann" and "Pebel" for "Pebal" being instances.

If, however, the defects here alluded to are remedied in the next edition, the book will, without doubt, serve as a very useful aid to students of physical chemistry.

H. M. D.

Practical Botany for Beginners. By F. O. Bower, Sc.D., F.R.S., and Dr. T. Gwynne-Vaughan, M.A. Pp. xi + 307. (London: Macmillan and Co., Ltd., 1902.) Price 3*s.* 6*d.*

THIS excellent little book, written by Prof. Bower in 1894, appears in a second edition after being subjected to careful revision. Mr. Gwynne-Vaughan now shares with Prof. Bower the author's responsibility. The more prominent changes are the adoption of the nomenclature introduced with the stelar conception and a more elaborate description of grosser morphological features. The number of seeds described is increased to eight Dicotyledons and three Monocotyledons, and more than twenty flowers are taken as types of these two groups. The main types remain the same, except that the elm gives place to the lime. Other additions are the stems of Ricinus, *Veronica Beccabunga* (aquatic Dicotyledon), *Elodea Canadensis* (aquatic Monocotyledon), and leaves of Ligustrum, Hedera, Deschampsia and Phormium. The paragraphs on reserve and transitory materials have been considerably added to and improved, so that suitable material and the necessary tests are given for demonstrating the presence of starch, proteids and various sugars in the vegetative parts and in seeds. Exception may be taken to certain types chosen—for instance, Marchantia and Fucus—but obviously the general occurrence of these has weighed with the authors in their choice. Passing to methods of manipulation, glycerine and chlor-zinc iodine are almost exclusively recommended as mounting media; in several cases, notably Pinus, double staining and mounting in Canada balsam would give better results, while mounting in water avoids undue swelling of the walls of phloem cells such as follows the use of glycerine and Schulze's solution.

The book is already so well known that it is unnecessary to emphasise the careful arrangement of subject and the clear descriptions which characterise it.

Quelques réflexions sur la mécanique suivies d'une première leçon de Dynamique. Par Émile Picard, Mem. Inst. France. Pp. 56. (Paris: Gauthier Villars, 1902.)

THE first part is based on a report drawn up by M. Picard in connection with the Paris Exhibition of 1900 dealing with modern views on the principles of mechanics and in particular on the "energetic" method, and the dynamical system of Hertz. The second part consists of the first lecture given by M. Picard, since 1894, in his course on general mechanics, introducing the elementary principles of dynamics. It differs somewhat from the conventional treatment, and in this country Newton's third law will probably be regarded as constituting a less artificial definition of *mass* than is used by M. Picard.

LETTERS TO THE EDITOR.

The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*]

Volcanic Eruption in Java, Brilliant Sunset Glows in 1901, and probable Glows from the Eruption in Martinique.

THE brilliant sky glows and sunsets following the eruption of Krakatoa, near Java, on August 26 and 27, 1883, threw a flood of light on the movements of the upper atmosphere in a way which was probably not otherwise possible. Up to that time it had been supposed generally by meteorologists that the air forming the trade winds ascended at the equator and turning toward the poles became a south-westerly current in the northern hemisphere and a north-westerly current in the southern hemisphere flowing over the trades. After the explosion eruption of Krakatoa, the large mass of observations gathered by the committee of the Royal Society and the admirable discussion of the optical phenomena by Russell and Archibald ("The Eruption of Krakatoa and Subsequent Phenomena," London, 1888) brought out the following facts:—

(1) The haze, sky glows and brilliant sunsets progressed from east to west three times around the world within the tropics at a rate of about seventy-five miles an hour.

(2) They spread northward and southward from 20° N. and 20° S. very slowly, taking from September 2 to about October 7 for the conspicuous phenomena to spread from 20° N. to 35° N. in America, a velocity of about one-half a degree a day, or one mile an hour.

(3) Above 35° latitude the progressive motion was rapid and apparently from the south-west in the northern hemisphere and from the north-west in the southern hemisphere.

There are two other important conclusions which I think may be drawn from the data, and these are:—

(1) The atmosphere between 20° N. and 20° S. moved with a nearly uniform velocity from the east; otherwise it would have been impossible to trace the movement of the dust cloud around the world three times, because a very slight difference in velocity or direction at different latitudes would very soon have destroyed the individuality of the cloud, whereas Russell's lines of first appearance are nearly parallel with each other between 20° N. and 20° S.

(2) There are frequent temporary disturbances in this region by which the air is carried rapidly outward in narrow belts into extratropical regions. One of these disturbances was shown on August 27, when the dust was carried rapidly to Japan, another on August 28, when dust was carried to South Africa, and another on September 1, when dust was carried to Santiago, Chili.

The movement of the atmosphere above the tropics established by this investigation differed so from that supposed to exist by meteorologists that it was sought to explain it as a temporary movement and not representative of average conditions. But Abercromby was so much impressed by the phenomena that he began to gather observations of the movements of cirrus within the tropics. These are published in the volumes of NATURE between 1887 and 1890. Hildebrandsson has pursued the subject farther, and his results show that in the equatorial regions between 20° N. and 20° S. the prevailing movement of the cirrus is from the east. North and south of these latitudes the directions change to a movement from the west. It is probable that between these two opposing belts of wind there is a nearly calm zone across which the air movesf very slowly from the equator.

These facts are dwelt on in order to show the importance of such observations preliminary to calling attention to recent sky glows and volcanic eruptions.

In the autumn of 1901, Mr. Rotch, Mr. Sweetland and myself noticed independently that the sunsets were more brilliant than usual at Blue Hill (lat. 42° 13′ N., long. 71° 7′ W.), and the following notes were entered in the records of the Observatory:—"October 7.—Since about September 20 the sunsets on clear days, including to-day, have shown unusually bright colours, a bright red predominating and lasting near the horizon for three-quarters of an hour or longer; November 2, a very brilliant sunset, red prevailing, and the colours continued for about forty-five